

Corn Silage for Beef Cattle

Homer B. Sewell

Department of Animal Sciences, University of Missouri-Columbia

Howell N. Wheaton

Department of Agronomy, University of Missouri-Columbia

Corn silage is a popular feed with Missouri cattle feeders. Harvesting corn as silage furnishes 50 to 60 percent more nutrients per acre for beef cattle than harvesting the grain alone, an important consideration for a cattle feeding enterprise that is tied closely to the farm feed supply.

Corn silage is often called the "king of roughages" for beef rations that produce 1-1/4 to 2 pounds daily growth gain. Corn silage is a safe feed. It works well for starting cattle on feed. Cattle are easily changed from corn silage to a high-grain finishing ration. Corn silage is often used to furnish minimum roughage levels in high-grain finishing rations.

Making high-quality corn silage

Harvest the corn plant at a stage of maturity that produces silage with 30 to 40 percent dry matter. Corn should be harvested for silage after the grain is well dented but before the leaves turn brown and dry (see MU publication [G4590](#), *Corn Silage*).

There is no advantage for corn silage with over 35 percent dry matter with respect to the nutrients produced per acre, digestibility of the silage, or in the dry matter consumed daily by beef cattle. The maximum percentage of grain in the silage is reached at a stage of maturity that corresponds to 35 percent dry matter silage. Further increases in dry matter of the silage are due to moisture lost from the corn plant as it matures.

The ideal moisture level depends somewhat on the type of silo used. Nutrients are lost in the drainage from a silo. Little seepage will occur from horizontal silos or small tower silos when dry matter levels range from 30 to 35 percent. There may be some seepage even when 35 percent dry matter silage is stored in large tower silos (30 feet x 70 feet).

Water should be added to forage with over 50 percent dry matter to prevent the formation of tobacco-brown silage. Cut corn silage 1/2 to 3/4 inch long, irrespective of maturity and moisture level.

Silage additives

There is no reliable evidence that adding enzymes, yeast cultures, antibiotics or acid-forming bacteria to improve silage quality is economical. Improving the feeding value of corn silage with these additives has been sporadic in research trials. The improvement, if any, has not paid for the cost of the additive in most cases. When corn silage costs \$20 a ton, a 5 percent increase in feed value is needed to break even if the additive application for a ton of silage costs \$1.

Feeding value varies

Corn silages vary in their nutrient content. One of the biggest variables is the percent moisture in corn silage. The nutrients in a ton of corn silage are related to the percent dry matter in the silage. Corn silages within the same year on a farm may commonly range from 30 to 45 percent in dry matter. If a pound of dry matter from each silage had the same nutrient content, the silage with 45 percent dry matter would have 1.5 times the amount of nutrients per ton on a wet basis as the 30 percent dry-matter silage.

The percent dry matter in silage must be considered when animals are fed a certain number of pounds of silage per head daily. Consumption on a dry matter basis will usually be similar on corn silages varying from 30 to 40 percent dry matter if cattle are fed to appetite — cattle eat more pounds of high-moisture feed.

Other factors affecting the feed value of silage are the ratio of grain to stalk, percent fiber, fermentation process and spoilage. Laboratory analysis should be made on corn silage to determine dry matter and nutrient levels for use in formulating rations.

Cost per ton

The cost of a ton of corn silage at the feed bunk must be known before you can figure the cost of beef gains when silage is fed or compare the cost of nutrients in silage with their cost in alternate feeds such as corn grain. The cost of corn silage is difficult to figure on most farms, but a number of formulas have been proposed for use in computing its cost. Components of these formulas include the value of grain in the field and the cost of harvesting, silo filling, silo storage and delivery to the bunk. Thus the bushels of grain and the tons of silage per acre must be estimated to arrive at the cost of corn silage.

The bushels of grain in a ton of corn silage vary with the yield of grain per acre, the percent moisture of the silage, and other variables. A rule of thumb is to figure five to six and one-half bushels of corn per ton of silage when yields range from 90 to 125 bushels per acre and the plant is harvested at a maturity to make silage with 30 to 35 percent moisture.

Cost of a ton of corn silage when corn sold for \$2.20 a bushel was \$20.59 a ton for 32 percent dry matter silage when calculated by a University of Missouri formula (Table 1).

Table 1. Cost of corn silage¹ per ton, with corn \$2.20/bushel at market.

Value of corn (6 bushels/ton)	a. Harvest-time price at field	\$2.20
	b. Less cost of harvesting and drying	0.20
	c. Net value of corn/bushel	2.00
Value of grain per ton of silage (6 x \$2)		12.00
Cost of custom harvesting and storing		2.75
Storage costs per ton: annual fixed cost		2.60
Storage losses per ton, \$17.35 (add lines 2, 3 and 4) x 10 percent		1.74
Value of fertilizer nutrients (N, P, K, Ca) removed in cob and stalk		1.50
Total cost/ton of silage		20.59
¹ Corn silage with 32 percent dry matter.		

Harvest and storage costs vary with the tons of silage made and other factors. Therefore, a price of \$17 to \$22 a ton for silage with 30 to 40 percent dry matter appears to be representative for many Missouri farms.

Horizontal or tower silos

Michigan State University trials indicated little or no difference in nutritional or chemical analysis of corn silage stored in trench or tower silos. Dry matter losses may be greater in trench than in conventional tower silos. The losses, however, can be kept similar if trench silos are built with 12- to 16-foot side walls. Depth improves compaction, decreases oxygen and reduces the percentage of total volume exposed to surface spoilage.

Keep silage fresh

The fermentation process is usually completed and the silage ready to feed by three weeks after storage. Silage is kept fresh and spoilage prevented on the feeding surface in upright silos if 2 inches of silage is removed daily in winter or 3 inches in summer. In trench or bunker silos, take 3 inches daily in winter and 4 inches in summer. The amount of silage to be fed daily should be used to determine the dimensions of the silo. Figure 35 to 40 pounds of silage per cubic foot in trench silos. Weight of silage per cubic foot increases from top to bottom in tower silos.

Corn silage in growing rations

Corn silage rations usually produce larger daily gains and more pounds of gain per acre of crop for growing beef calves than sorghum or milo silage or other silage crops. Feeder calves will consume from five to seven pounds of corn silage for each 100 pounds of body weight. A 400- to 500-pound feeder will eat from 25 to 35 pounds of silage daily. A full feed of corn silage properly supplemented with protein and minerals, and synovex or Ralgro® implants or MGA® supplements for heifers, produces about 1.33 to 1.75 pounds daily gain on this weight feeder.

Supplements for growing ration

See Table 2 for the percent crude protein, TDN, calcium and phosphorus on a dry matter basis needed in the ration of a 500-pound steer that gains 1.5 pounds daily. The percent of these nutrients in the dry matter of corn silage shows that corn silage is deficient in protein and slightly deficient in calcium and phosphorus for growing beef cattle. To meet the daily requirements of the steer, a full feed of corn silage would need to be supplemented with 1.5 pounds of a 40 percent protein supplement.

Table 2. Corn silage deficient in crude protein, Ca and P.

	Percent nutrients — dry matter basis ¹			
	Crude protein (%)	TDN (%)	Ca (%)	P (%)
Corn silage	8.1	70	0.27	0.20
Daily requirement: Growing 500# steer, 1.5 daily gain	11.1	66	0.31	0.25
Finishing 600# steer, 2.4 daily gain	12.2	74	0.38	0.29

¹Nutrient Requirements of Beef Cattle, No. 4, NRC, 1970.

The calcium and phosphorus deficiency in silage can be supplied in the protein supplement or by offering a free-choice mixture of equal parts dicalcium phosphate and trace mineralized salt. Feeding 15,000 I.U. of vitamin A per head daily is recommended for protection against this vitamin deficiency, which sometimes occurs to cattle fed corn silage rations. Other fortifications of silage rations that are usually profitable include 70 to 80 milligrams of antibiotics per head daily and growth stimulants such as stilbestrol, Ralgro® or MGA® (for heifers).

Performance may be decreased when much more than 50 percent of the protein equivalent in a supplement fed with silage is derived from urea. Some work has indicated that high-urea supplements should not cost over two-thirds as much as an equivalent plant protein supplement for equal economy of gain when fed with all-corn silage rations. See MU publication [G2073](#), *Urea and Mineral Additives for Corn Silage*, for information on adding urea and minerals to corn silage at ensiling time. This has been an economical way to correct the deficiencies of corn silage for beef cattle in many research and farm situations.

Corn silage in finishing rations

Work at the University of Missouri and other experiment stations shows corn silage is used more efficiently in feeding systems that made maximum use of silage in the growing period. For example, in a 230-day growing-finishing period, the most efficient use of corn silage is made when the silage is full-fed for the first 115 days, and corn grain is full fed with five to 10 pounds of silage per head daily the last 115 days.

A similar system is to feed one-half to one pound of grain per 100 pounds of body weight with a full feed of silage until the cattle weigh around 800 pounds and then increase grain to one to two pounds per 100 pounds of body weight.

Another successful method that maximizes corn silage is to add one pound of grain to the silage for each 100 pounds of body weight of the cattle and full feed silage throughout the feeding period. Cattle can be finished to low choice grade, however, on high-quality corn silage rations that have little or no grain additions.

Minimum levels of corn silage in ration

A limited amount of roughage in high-grain rations usually decreases the number of liver abscesses, founder and other digestive problems. Experimental work indicates that five to 10 pounds of corn silage per animal daily supplies adequate roughage in these high-grain finishing rations. Silage fed in excess of this level is often poorly used and gives little

reduction in the amount of grain needed for a unit of gain with this type ration.

Corn silage vs. corn grain

Cost of a ton of corn silage in relation to its nutritive value for beef cattle determines whether corn silage will give cheaper gain than corn grain or other feeds. Thus, when corn cost \$2.20 a bushel, a ton of silage is worth a certain sum as an alternate feed to supply nutrients at the same cost. There is a limit to the amount of harvesting, storage and handling costs that corn silage can incur and remain a cheap source of nutrients.

Cattle usually gain more slowly when corn silage replaces large amounts of corn in the ration. Slower gains mean more days to produce 100 pounds of beef. When the total cost of beef production is figured, corn silage must be charged with any non-feed costs attributed to more days in the feedlot for a unit of gain. Non-feed costs are often assessed at 10 to 15 cents a day for commercial lots. Farmer-feeders who handle only one group of cattle a year may have little extra non-feed cost because cattle require more days to finish.

Other factors to consider in comparing high-silage with high-corn rations are:

- Dressing percent of cattle fed high-silage rations is usually less.
- Cattle fed high-silage rations are likely to have carcasses that yield a higher percent of closely-trimmed retail cuts.
- If cattle are fed to equal slaughter weights, carcass quality grades are usually similar on the two systems.

When comparing corn silage with corn grain, the feed that returns the largest net income may depend upon whether income is figured on the basis of an acre of corn, a steer, or feedlot capacity. An illustration would be an Iowa State University experiment, where the net return per acre of corn was higher with corn silage than when only the grain was harvested. More steers per acre were finished when the corn crop was made into silage. In contrast, corn grain gave more net return per steer. The higher net per steer coupled with faster daily gain for those fed high-grain rations yielded more yearly net return per head of feedlot capacity for cattle fed high-corn rations.

Drought silage

Using silage is a way to salvage some feed from a drought stricken corn crop that yields little grain. In some investigations, silage from drought-stricken corn yielding as little as 10 bushels per acre has been nearly equal in feed value on a dry matter basis to silage from a normal crop. Drought silage has yielded much less nutritive value in other cases. The extent of drought damage is a factor.

Effective use can be made of drought silage. In most cases, the largest reduction in value will be in reduced tonnage per acre and increased harvesting cost.

Sorghum silage

There are two types of sorghum silage; forage and grain.

Forage. Corn silage is usually superior to forage sorghum silage in producing beef. Sorghums, however, are more drought tolerant and adapted to a wider range of soils than corn. Ten years of work at Auburn Agricultural Experiment Station showed yearling steers wintered on forage sorghum silage consistently gained less than those fed corn silage (1.25 vs. 1.50 lbs. average daily gain). Both sweet sorghum and high grain yielding hybrid varieties were used.

Adding 100 pounds of ground shelled corn to a ton of forage sorghum silage at ensiling improved animal gain and was more valuable than additions of limestone or urea in the Auburn trials.

Grain sorghum. Growing sorghum grain (milo) for silage will produce fewer pounds of beef per acre of crop than corn silage on land suited to corn. Tonnage of silage from an acre is less, and more pounds of dry matter from grain sorghum silage, compared to corn silage, are required to produce a pound of beef gain.

Sometimes the sorghum plant is harvested below the head to make a high-grain silage. Work at several experiment stations has shown that rolling grain sorghum silage to crush the grain greatly improved its feed value. Rolling has improved the feed conversion of grain sorghum silage from 8 to 20 percent. Much of the whole grain in grain sorghum silage is not utilized by cattle.

Sorghum-Sudan grass silages

Sorghum-Sudan grass hybrids have created much interest as pasture, hay or silage crops for beef cattle. They resist drought, yield high tonnage and adapt to a variety of soil types and fertility levels. Tonnage of dry matter produced per acre, however, is a faulty measure of production for livestock feeds. Animal performance depends on the level and digestibility of nutrients and the palatability of the forage. The class of cattle that utilizes the forage will be a factor, too.

A roughage that gives maximum production of profits per acre as a feed for wintering a mature cow may be too low in available energy or other "quality" factors to be suitable for young animals or cattle in the feedlot. Hybrid-sorghum silages produce about 85 percent as much beef per acre or daily rate of gain as corn silage when fed in growing rations.

Turner, Director, Cooperative Extension Service, University of Missouri and Lincoln University, Columbia, Missouri 65211. • University Extension does not discriminate on the basis of race, color, national origin, sex, religion, age, disability or status as a Vietnam-era veteran in employment or programs. If you have special needs as addressed by the Americans with Disabilities Act and need this publication in an alternative format, write ADA Officer, Extension and Agricultural Information, 1-98 Agriculture Building, Columbia, MO 65211, or call (573) 882-7216. Reasonable efforts will be made to accommodate your special needs.